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ABSTRACT

Curriculum administration and evaluation require specific information on such curriculum components as content, time, teaching methodology, materials, evaluation, and scheduling. Without such information, planning, coordination, resources allocation, and other decision-making activities are severely handicapped. Furthermore, evaluation of the curriculum to determine a program's congruence with institutional goals and objectives is difficult and rarely undertaken. While curriculum guides and course syllabi provide readily available overviews of desirable curriculum, they are often vague, lack specificity, and do not represent the real curriculum. Curriculum mapping was developed by Fenwick W. English (1978) to identify the status quo and reveal the actual school curriculum. A feasibility study for the New York State Bureau to School Libraries applied the process, and addressed data manipulation problems by using a computer-based system called CMAP, developed on an IBM 4341 mainframe system in the APL programming language. A microcomputer-based CMAP system was developed by adapting existing microcomputer file management software. By applying microcomputer capabilities to curriculum mapping, educators have a powerful tool for analyzing and managing curriculum. This paper includes a seven-item reference list and a curriculum map worksheet. (LMM)

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MICROCOMPUTER-BASED CURRICULUM MAPPING: A DATA MANAGEMENT APPROACH

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INTRODUCTION

Information about curriculum is essential for successful planning, implementation and evaluation of educational programs. Curriculum mapping, a technique based upon the procedures of content analysis, has potential as a tool for the management of curriculum information. Until recently, the effectiveness of curriculum mapping was limited by the problems associated with storing, manipulating and updating large amounts of data, and the inability to easily view the information from different perspectives. Microcomputer-based data management systems provide a readily available tool for overcoming the management difficulties of manual curriculum mapping.

CURRICULUM CONCERNS

Curriculum is a central concern in education at all levels. Encompassing the objectives of instruction and the scope and sequence of content, curriculum is the conceptual heart of the educational process. Implementation and administration of curriculum and components (i.e. course content, time frame and sequence, teaching methodologies, instructional materials, evaluation methods) are difficult tasks at best. Without specific information on these components, planning and coordination, allocation of resources and other decision-making activities are severely handicapped.

Furthermore, analysis of curriculum to determine if the educational program in operation reflects the goals and objectives of the institution is cumbersome and rarely undertaken. While standardized test results may give some insight into overall effectiveness, they do not provide much detail and are not always available. Local test scores indicate how well students are meeting the internal requirements of the curriculum, not whether or not the curriculum meets the overall intentions of the program. This requires a special mechanism for curriculum review.

There have been detailed research studies of curriculum in relation to program objectives, for example the "evaluation

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of competencies" study conducted by Daniel and Ely at Syracuse University. (1) In the late 1970's, an integrated competency-based program for the preparation of school media professionals was developed in response to a mandate from the New York State Education Department. (2) Those enrolled in the program were to attain minimum proficiency in seventy (70) designated competencies. An early question arose concerning the evaluation of the curricula of both the School of Information Studies and the Area of Instructional Design, Development and Evaluation, School of Education to determine whether or not the objectives, content and evaluation procedures of courses covered the defined competency areas. Relying primarily on direct evaluation by instructors, the 1979 study sought to determine which specific competencies were included in the content of courses and which methods were used to evalute students' attainment of the competencies. This study demonstrated useful stategies for the assessment of competency effectiveness and along with other specific curriculum research projects, is related to the more general curriculum mapping technique proposed below.

Curriculum also relates to the specifics of what students do, i.e. how students, teachers, and content interact. Curriculum defines what is taught, in what order, with what methods and materials, and how it is evaluated. For example, the New York State Education Department recently developed a new elementary (K - 6) library media skills curriculum. (3) A key assumption in the design of the curriculum was that the objectives of library media skills instruction are best accomplished by coordinating and integrating media skills instruction within the general content of the classroom program. Successful integration requires a familiarity with both the library media skills curriculum and the school's curriculum by administrators, media specialists and teachers. As stated in the introduction to the New York State curriculum, "Knowledge of your school's curriculum is essential for determining which of the skills...should be part of your program, at which grade level they first seem necessary, and within which subject area they can be taught." (3 p. 4) It is obvious that a need exists for systematic curriculum review.

CURRICULUM INFORMATION SOURCES

What tools presently exist which aid in the examination of curriculum?

One source of readily available information for secondary and elementary education is the curriculum guide: state,

district or building. The most well-known of these are the overview, global guides published by the education departments of all states (e.g. The Elementary School Curriculum: An Overview (4)). These guides provide a valuable overview of what the curriculum "should be", what is considered important state-wide, and serve as a common point of reference for the various districts in a state. Although a general time frame is usually noted, there is little attempt to specify the degree of emphasis or time schedule of particular topics. State-wide guides do not represent the actual district or classroom curriculum and are of limited value in the type of planning and evaluation activities previously mentioned.

District or building-level guides are more detailed in outlining subjects and sequence within and across grade levels. These documents, usually created by a committee of teachers and administrators, reflect the overall emphasis and intent of the district. Fenwick W. English, referring to curriculum guides on the building level, acknowledges that "curriculum guides assist teachers in knowing that a topic or subject came before or will come after another topic in a particular K - 12 sequence, but within those parameters, the amount of time, emphasis, pacing, and iteration are the domain of teachers to decide." (5 p. 149) Even these guides are of limited value to the administrator, teacher or media specialist interested in more than shallow analysis. They are vague, lack specificity, and do not represent the actual curriculum as applied by individual teachers. English has called these curriculum guides, "the fictional curriculum." (6 p. 15)

CURRICULUM MAPPING

Rather than general, future oriented documents, those interested in curriculum need accurate assessments of the current state of affairs in an educational institution. A process for identifying the status quo, for revealing the existing curriculum, has been labeled curriculum mapping by Fenwick English. English bases his technique on the descriptive research method of content analysis (which involves procedures for analyzing written or oral communication, e.g. counting the number of newspaper pages or column inches dedicated to various issues to determine predominant attitudes, interests or values). A curriculum map is a "descriptive portrait of what tasks and how much time were spent on any given set of items, concepts, skills, or attitudes." (7 p. 8-9) Mapping is intended to reveal the bottom line, the actual curriculum being taught to students. "A map is not a lesson plan. A map is past oriented; it is a recording of what was taught." (7 p. 8)

Gathering data for mapping is a relatively simple process. A basic component for analysis, usually the instructional unit or topic, must first be established. Secondly, the elements of interest relating to the unit must be identified (i.e. unit sequence, total time allotted, instructional methods, resources, organization of instruction, evaluation procedures). Actual data can be collected through independent observation or having instructors document their classes in response to the designated categories. Figure 1 is a form designed for both methods. In either case, there must be systematic and consistent compilation of data independent of what others are doing and an earnest attempt to record what is "real," not what "should be." Using outside observers can save valuable instructor time and lead to increased uniformity and reliability, however the costs are greater.

Once the data has been collected, a compiled, articulation of some or all of the elements in a chart or graph is a curriculum map. The completed map can serve as the source of information for a range of needs, for example identifying repetition or gaps in content, how much of what is taught is assessed, the focus of a given grade level, course or subject area, patterns and variations across grade levels or among instructors teaching the same course, the degree to which curriculum guides, outlines, syllabi are being implemented, and/or the level and potential for inter-disciplinary cooperation.

CURRICULUM MAPPING EFFORTS

A project which sought to use curriculum mapping for this kind of identification process involved the previously described effort of the Bureau to School Libraries, New York State to implement its newly developed library media skills curriculum. As stated, the clear intent was to conduct media skills instruction through integration with classroom content. If this effort was to succeed, it seemed logical that those units in a school's curriculum most suited to media center involvement needed to be identified. For example, a unit organized for small group instruction, which used multiple materials on an expanded level of instruction is a more likely candidate for coordination with library media skills than an introductory unit relying on the lecture method and a single textbook. Similarly, a unit which resulted in a project, paper or product indicated more of a need for media center activity than one which culminated in a multiple-choice exam.

As curriculum mapping is a tool ideally suited for this purpose, a small study was initiated to test the feasibilty and usefulness of the technique in a real setting. Little trouble was encountered in setting up the parameters for study and in gathering data. While a simple map could be generated, it soon became apparent that when the number of fields of interest regarding units rose above three, storage and display of information became difficult and unwieldly.

One attempt to overcome the problems of manipulating the extensive data collected was a computer-based system called CMAP developed on an IBM 4341 mainframe system in the APL proramming language. Designed as an automated curriculum information system, CMAP is structured on the curriculum unit as a primary field with other fields reflecting information collected about the unit. Figure 2, a sample record from CMAP, shows the eleven fields in the record including time span (in minutes per week per semester), sequence (as indicated by calendar quarter), and the specifics of instruction (i.e. methodology, materials, organization, level, and evaluation).

Figure 2: A record in CMAP.

```
147    (RECORDNUMBER)
10     (GRADE)
75     (MINUTES/WK/SEM)
2ND QUARTER      (CALENDAR)
HUMAN BODY                    (UNIT)
GENERAL SCIENCE          (SUBJECT)
LECTURE             (METHOD)
TEXT                     (MATERIALS)
INTRODUCED      (LEVEL OF INSTRUCTION)
LARGE GROUP     (ORGANIZATION OF INSTRUCTION)
TEST            (EVALUATION)
```

CMAP allowed searching by each field, saving of retrieved sets, boolean manipulation of search sets, and three alternative formats for reporting information. Figure 3 is a portion of a map created on CMAP for an elementary school curriculum. Note that the unit New York History can be identified as potentially meeting the criteria for media skills integration described above as it was a major unit (averaging 25 minutes of class time per week per semester - more than any other third grade unit listed) and used a combination of teaching methods. After requesting full information from CMAP (see figure 4), the unit appears even more appropriate as it required multiple materials and a product for evaluation.

Figure 3 - Elementary School Map

UNIT	RECNUM	GRADE	QUARTERS	MIN/WK/SEM	METHOD	SUBJECT
AIR	102	3	3 4	20	LAB	SCIENCE
WEATHER	104	3	1 2	20	LAB	SCIENCE
LOCATION	118	3	2	15	INDIVIDUALIZED	LIBRARY MEDIA
MYTHOLOGY	122	3	1 2	20	COMBINATION	LANGUAGE ARTS
BOOKMARKS	129	3	1	10	COMBINATION	ARE
FOLK TALES	132	3	3	20	COMBINATION	LANGUAGE ARTS
NEW YORK	135	3	2	25	COMBINATION	SOCIAL STUDIES

Figure 4 - Record from Elementary Map

```
135    (RECORDNUMBER
3    (GRADE)
25    (MINUTES/WK/SEM)
2ND QUARTER    (CALENDAR)
NEW YORK HISTORY              (UNIT)
SOCIAL STUDIES           (SUBJECT)
COMBINATION           (METHOD)
MULTIPLE SOURCES           (MATERIALS)
INTRODUCED    (LEVEL OF INSTRUCTION)
COMBINATION    (ORGANIZATION OF INSTRUCTION)
PRODUCT           (EVALUATION)
```

The CMAP system was successful in solving most of the data manipulation limitations of manual mapping. Unfortunately, since it was based in a mainframe computer and required APL capabilites, the system was not immediately accessible to a wide range of users. In addition, in discussions with practitioners and colleagues interested in the system, it became apparent that the ability to modify the system for individual needs was highly desirable. The use of an automated mapping system at the university level, for example, would require a slightly different emphasis and structure than the elementary map of figure 3. Thus, the ability to easily adapt the system to local situations became a central concern. Consideration was given to the design of a microcomputer-based CMAP system which would fulfill the dual objectives of automated curriculum mapping and local design of the logical file structure. Rather than create a completely new data management system, it was decided that many of the existing file management systems for popular microcomputers might be adapted for the curriculum mapping purpose. If this approach was successful, it would also demonstrate that the tool of automated curriculum mapping was not tied to a specific hardware/ software configuration. Curriculum mapping could therefore be implemented in settings with minimal microcomputer capabilities.

DATE_____

FIGURE 1:
CURRICULUM MAPPING WORKSHEET

GRADE_____ INSTRUCTOR_____ SUBJECT_____

UNIT_____

TOTAL HOURS OF INSTRUCTION_____

WEEK STARTED_____

WEEK ENDED_____

LEVEL OF INSTRUCTION_____

- INTRODUCED
- REINFORCED
- EXPANDED

PRIMARY TEACHING METHOD_____

- DESK WORK
- LECTURE
- DEMONSTRATION
- DISCUSSION
- INDEPENDENT STUDY
- PROGRAMMED (INCLUDES LEARNING STATION)
- PROJECT
- REPORT

MATERIALS_____

- TEXT
- ONE SOURCE
- MULTIPLE SOURCES

ORGANIZATION OF INSTRUCTION_____

- LARGE GROUP
- SMALL GROUP
- INDIVIDUAL
- COMBINATION

EVALUATION

- TEST
- OBSERVATION
- PRODUCT
- REPORT

OBJECTIVES (OPTIONAL)_____

_____

_____

*ADAPTED FROM A FORM USED BY THE EAST BATON ROUGE, LOUISIANNA PARISH SCHOOLS, SEE FENWICK W. ENGLISH, QUALITY CONTROL IN CURRICULUM DEVELOPMENT (ARLINGTON, VA: AMERICAN ASSOCIATION OF SCHOOL ADMINISTRATORS, 1978) PP. 36-39.

File/data management systems for popular microcomputers did provide a readily available method for implementing computer-based curriculum mapping in a variety of situations. The various systems require the user to define the logical record structure thus providing the desired flexibility in file definition. Storage capacity, while limited by the mass storage devices present (typically one or two 5 1/4" floppy disks allowing from 200 - 1000 records), do provide enough space for analysis of major portions of a school's curriculum. As systems do vary as to search, sort and report capabilities, the creative manipulation of these features to arrive at the map desired is often necessary. The major objective of providing alternatives to the time-consuming and inefficient task of manually creating the map with its singular, rigid display is accomplished.

Figure 5 is a segment from a map created on a TRS Model 16 microcomputer using the Profiles III+ file management system. The map was an initial attempt to document the

Figure 5 - University level curriculum map

Computer Skill	Computer	Software	Time Course	Date	Level
familiarity	IBM 4341	XEDIT	1.25 IST 383	0926	introduced
familiarity	DEC-10	SOS	6.25 IST 255	0913	introduced
familiarity	micros	DOS, gen.	1.50 IST 667	0913	introduced
file management	TRS-80	PROFILEIII	5.50 IST 667	1101	introduced
online search	DEC-10	DIATOM	25.50 IST 637	0919	introduced
online search	off campus	DIALOG	12.50 IST 637	1107	introduced
online search	off campus	BRS, NIM,..	19.25 IST 630	0928	advanced
online search	off campus	DIALOG	5.50 IST 630	0913	advanced
program - APL	IBM 4341	APL	12.50 IST 383	1003	intorduced
program - BASIC	DEC-10	SOS, BASIC	20.50 IST 255	0920	introduced
program - PASCAL	IBM 4341	PASCAL	38.50 IST 571	0913	expanded
SAS	IBM 4341	SAS	2.50 IST 383	1114	introduced
SAS	IBM 4341	SAS	2.00 IST 670	0913	introduced
spreadsheets	Apple/TRS	VISICALC	7.50 IST 667	1004	introduced
word processing	IBM 4341	XEDIT	2.50 IST 383	1121	introduced
word processing	DEC-10	SOS/RUNOFF	6.50 IST 667	0920	introduced

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*Note: Most file managment systems available for microcomputers which will meet the needs of curriculum mapping. Some examples of commercial software are dBaseII for CP/M and MS-DOS systems, PFS File for AppleDOS and TRSDOS, Data Manager for Apple, and Profile III+ for TRSDOS.

Information Studies, Syracuse University. Data elements represented selected courses from the Fall 1983 semester. Displayed fields of particular interest for curriculum review include total time of classroom instruction, hardware, software, and the level of skills development. The completed map can be used to identify areas of emphasis, overlap and gaps, and also to determine demand for particular computer systems and software. Within the limitations of fixed length fields, the profiles III+ management system provided for realatively easy definition of the file components and adjustments as necessary.

SUMMARY

In summary, curriculum mapping is a highly useful and adaptable tool for probing into the specifics of curriculum. In addition, a curriculum map provides a picture of emphasis and general trends in an educational program. By applying microcomputer-based file management software to the task of mapping educational institutions at all levels have available a powerful tool for planning, analysis and evaluation.

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